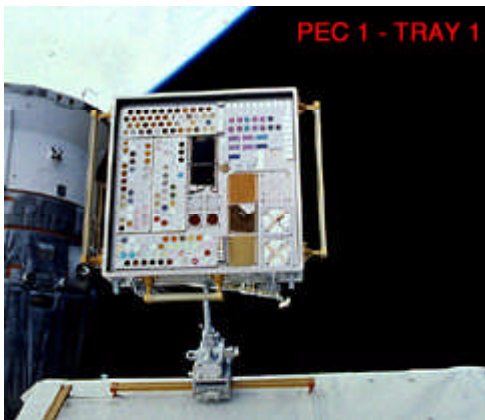


Materials International Space Station Experiment (MISSE) 5 Developed to Test Advanced Solar Cell Technology Aboard the ISS

The testing of new technologies aboard the International Space Station (ISS) is facilitated through the use of a passive experiment container, or PEC, developed at the NASA Langley Research Center. The PEC is an aluminum suitcase approximately 2 ft square and 5 in. thick. Inside the PEC are mounted Materials International Space Station Experiment (MISSE) plates that contain the test articles. The PEC is carried to the ISS aboard the space shuttle or a Russian resupply vehicle, where astronauts attach it to a handrail on the outer surface of the ISS and deploy the PEC, which is to say the suitcase is opened 180°. Typically, the PEC is left in this position for approximately 1 year, at which point astronauts close the PEC and it is returned to Earth. In the past, the PECs have contained passive experiments, principally designed to characterize the durability of materials subjected to the ultraviolet radiation and atomic oxygen present at the ISS orbit. The MISSE5 experiment is intended to characterize state-of-art (SOA) and beyond photovoltaic technologies. The following photograph shows PEC1 attached to the ISS.



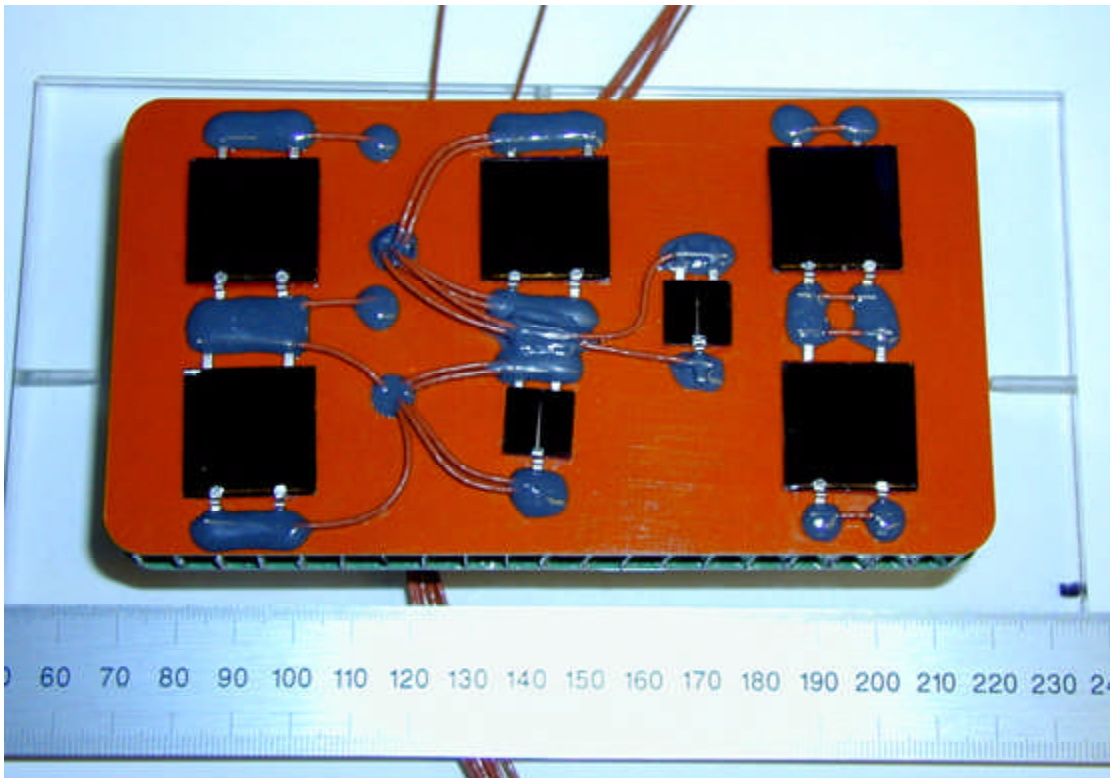
MISSE1 aboard the ISS.

Photograph of a Materials International Space Station Experiment (MISSE) housed inside a Passive Experiment Container (PEC), a suitcase-sized payload (2 by 2 by 0.5 ft) that is carried aloft in the shuttle and attached to the exterior of the International Space Station. After approximately 1 year on-orbit, the payload is returned to Earth. MISSE5 is the fifth in the series, and its objective is to characterize the in-space performance of advanced solar cell technologies.

The MISSE5 experiment differs from previous versions by virtue of the active nature of the payload. MISSE5 includes a photovoltaic power system and an onboard data acquisition and storage system, which was designed and fabricated by engineers from the Optical Instrumentation Technology Branch at the NASA Glenn Research Center and the

Ohio Aerospace Institute (OAI). The electronic characterization system will measure the individual current-voltage characteristics of the 36 test solar cells as well as collect data from numerous other sensors (temperatures, Sun angle, etc.). The primary focus of MISSE5 is the characterization of commercial SOA multijunction solar cells from Emcore and Spectrolab. The data collected will be stored onboard as well as transmitted to Earth approximately once every 4 min, where it will be autonomously collected by ground stations.

Glenn, in collaboration with the Ohio State University and the Massachusetts Institute of Technology (MIT), has developed advanced high-efficiency gallium-arsenide- (GaAs-) based solar cells on silicon (Si) substrates. The use of Si substrates offers significant mass, area, and thermal benefits, although significant technical challenges have had to be addressed. Glenn was asked by the Naval Research Laboratory (NRL--the primary MISSE5 experiment integrator) to supply MISSE5 with GaAs/Si test articles. The MISSE5 GaAs/Si experiment plate (see the following photograph) was fabricated at Glenn. It contains five GaAs/Si cells, three of which will be electrically characterized on-orbit. In addition, a GaAs/GaAs control cell will be characterized on-orbit. The remaining samples will be measured after flight to compare with their preflight characteristics.



MISSE5 gallium arsenide on silicon (GaAs/Si) solar cell flight article developed by Glenn, the Ohio State University, and MIT.

GaAs/Si MISSE5 experiment plate, which contains five GaAs/Si experimental devices fabricated by the Glenn, Ohio State University, MIT team along with two GaAs/GaAs reference cells. This plate will be mounted on the MISSE5 payload, where current-voltage data from selected devices will be returned during its on-orbit mission.

MISSE5 is being assembled at the Naval Research Laboratory and is scheduled to launch aboard a Russian resupply vehicle (fall 2004). This mission will provide valuable in-flight data for SOA technologies as well as promising new technologies, such as the GaAs/Si technology and advanced thin-film technologies. Finally, the cell characterization electronics developed by Glenn for MISSE5 are already being considered for use in future spacecraft.

Find out more about this research:

Photovoltaic & Space Environments Branch at Glenn:

<http://powerweb.grc.nasa.gov/pvsee/>

MISSE: <http://misse1.larc.nasa.gov>

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Programs/Projects: All of NASA's solar-powered space missions and projects